Encinitas-Solana Beach Coastal Storm Damage Reduction Project

San Diego County, California

Appendix F

Cost Estimate

U.S. Army Corps of Engineers
Los Angeles District

December 2012

This page intentionally left blank.

Section **Page**

1 Overview

This paper discusses the cost assumptions and construction methodology utilized in the Encinitas and Solana Beach Shoreline Feasibility Study.

The Solana Beach-Encinitas shoreline study area is located along the Pacific Ocean in the Cities of Solana Beach and Encinitas, San Diego County, California. The City of Encinitas is approximately 10 miles (mi) south of Oceanside Harbor, and 17 mi north of Point La Jolla. The Encinitas shoreline is about 6 mi long. It is bounded on the north by Batiquitos Lagoon and on the south by San Elijo Lagoon. Immediately south of the City of Encinitas is the City of Solana Beach. Solana Beach is bounded by San Elijo Lagoon to the north and by the City of Del Mar on the south. It is approximately 17 mi south of Oceanside Harbor, and 10 mi north of Point La Jolla. Solana Beach's shoreline is about 2 mi long.

The project area consists of two segments. Segment 1 (Reaches 3, 4, and 5) exists within the City of Encinitas and is approximately 2.0 mi in length; Segment 2 (Reaches 8 and 9) exists within the City of Solana Beach and is approximately 1.4 mi in length.

The non-Federal sponsors are the City of Encinitas and the City of Solana Beach.

Project purpose is to reduce coastal storm damage and shoreline erosion at Encinitas and Solana Beach. Recommended plan involves the use of a hopper dredge to excavate sand from offshore borrow sites and pumping it to Encinitas and Solana Beach.

The Cost Engineering Dredge Estimating Program (CEDEP) program was used to compute hopper dredging unit costs for Encinitas (Segment 1) and Solana Beach (Segment 2). The dredging unit costs were transferred to the Micro-Computer Aided Cost Engineering System, Second Generation (Mii) software program. Current Working Estimate (CWE) meets the Standard USACE Civil Works Work Breakdown Structure (WBS).

2 Direct Cost

Unit costs for mob/demob and hopper dredge operations were calculated using the Hopper Dredge CEDEP program. The CEDEP dredging units cost accounts for the dredging operation of a single event. Unit costs for the pump-out pipelines were calculated on a separate CEDEP run from a division of the Pipeline Dredge CEDEP program. Unit costs for the hopper dredge, pump-out pipeline, mob/demob and shore crews were integrated in MCACES (MII). There are a total of three MCACES (MII) estimates. One MII estimate for the initial event, a second MII estimate for subsequent Solana Beach events (one contract) and a third MII estimate for subsequent Encinitas Beach events (one contract).

The total project cost is broken down into three estimates. One estimate was prepared for the initial dredging event where the Solana and Encinitas segments are assumed to be awarded under contract. The initial combined Solana-Encinitas estimate includes associated mitigation and monitoring cost incurred within the first 5 years for the Encinitas reach and the first 13 years for the Solana reach. The other two estimates were prepared, individually, for Solana and Encinitas subsequent dredging events including associated mitigation and monitoring costs lapsing through the remaining years of the 50-yr project.

Labor rates used to develop the estimate were provided from latest Davis-Bacon Wage Rates for San Diego County, Heavy and Dredging.

Equipment rates are based on the US Army Corps of Engineers EP 1110-1-8 "Construction Equipment Ownership and Expense Schedule", Region 7 and CEDEP.

Crews were developed for project specific application and are listed in the crew database.

3 Dredge Quantity and Material Analysis

In Encinitas (Segment 1), approximately 820,000 CY of beach quality sand would be initially placed along 1.5 mi of shoreline providing a nourishment width of 100 ft. The beach fill would then naturally slope seaward at a slope of 10:1. Beach replenishment of an additional sand volume of 336,469 CY would occur on average every 5 years within the 50-year project lifetime.

In Solana (Segment 2), approximately 1,180,000 CY of beach quality sand would be initially placed along 1.4 mi of the shoreline, providing a nourishment width of 200 ft. The beach fill would then naturally slope seaward at a slope of 10:1. Beach replenishment of an additional sand volume of 499,299 CY would occur on average every 13 years within the 50-year project lifetime.

Dredging area within the CEDEP program is based on the given volumes for each segment and a bank height of 3-feet.

Material classification assumed: 6% fines, 92% sand and 2% gravel. Material classification is directly linked to the excavating or pumping rate of the dredge.

4 Dredge Equipment Selection

Equipment selection and sizing were developed through construction cost estimator experience and consultation with the designer and study manager.

A medium-sized hopper dredge with pump-out capabilities is selected due to the long haul from the sand source to the receiver beach. Selected hopper maximum safe load capacity is 2,500 CY; however the effective capacity is 1,750 CY for sandy material. The hopper pump-out capabilities permit reverse pumping the dredge material via a pipeline.

The dredge and construction equipment are expected to operate on a 24/7 basis. Construction is planned to occur during a period of seasonably mild wave climate between April and September. And two (2) beach access/temporary staging areas will be required for the term of construction.

5 Fuel Adjustments

Of all the dredging equipment available, hopper dredges are the most sensitive to fuel price fluctuations. Out-in-the-ocean delivery marine diesel fuel cost was estimated from a quote from a local supplier.

6 Quantity Analysis

Quantities are based on dredged volumes instead of placement volumes. Dredge quantities assume 20% loss by volume. Placement quantities are based on shoreline modeling and erosion rates.

Take-off and hauling distances were provided by Noble Consultants (Chia Chi Lu, PE). Given volumes were used to run the CEDEP estimates and develop dredging unit costs.

7 Dredging Construction Methodology

Dredging operation mirrors the beach nourishment work that took place at San Diego, in 2001. The selected hopper is equipped with an installation at the bow of the ship, which makes it possible to connect to a moored floating/sunken pipeline in the open sea.

The first step in beginning the beach replenishment process involves transporting and installing the sunken/floating beach access pipeline. The dredge is attached to a floating section of the pipeline which is connected to the submerged pipeline section.

The hopper dredge is filled at the designated S0-6 borrow site and hauled 2.5 miles to Encinitas (Segment 1) and 1.9 miles to Solana (Segment 2). At the receiver beach, the dredge is attached to a moored floating section of pipeline extending 2,640 feet to the shoreline. The material is re-suspended and discharged through its on-board pumping system to the receiver site.

Total pump-out pipeline length consists of 2,640 LF of submerged/floating pipeline, in addition to the shore pipeline. Shore pipeline length amounts to 1,500 lf for the Encinitas segment and 3,500 lf for the Solana segment.

For the Encinitas segment the mooring site where the hopper dredge connects to pump-out the slurry to the shore will be relocated 3 times.

The Solana segment allows for only one central pump out slurry location, therefore pump-out mooring site once established will not be relocated.

Remove submerged and shore pipeline upon completion.

The shore crew was broken down in two parts: morning crew and night (skeleton) crew. The morning crew consists of a loader (severe conditions), a dozer (severe conditions), fill placer, shoremen and a superintendent. The morning crew will build berms, contain the slurry, and build a gigantic hole for the night pumping. The beach is graded so that a basin is created by the morning crew to contain the slurry pumped at night.

8 Dredge Mobilization and Demobilization

Includes hopper dredge and moored/sunken pipeline transfer, setup and dismantle. Since there is very little hopper dredge work on the west coast, a more likely scenario is that a hopper dredge would mob/demob from the Gulf of Mexico or from the east coast. The distance from New Orleans to Los Angeles is approximately 4,300 nautical miles (5,000 statute miles).

9 Dredging Schedule

Dredging operation is performed 24-hours a day, 7 days a week. Dredging shore crew operation is performed 12-hours a day, 7 days a week. Contract restrictions limit our operating time on the beach to meet noise ordinances. Dredging contracts limit heavy equipment

operations on the beach between 7:00 am and 7:00 pm, but marine equipment is allowed to work 24-hours a day.

The shore crew was broken down in two parts: morning crew and night (skeleton) crew. The morning crew consists of a loader (severe conditions), a dozer (severe conditions), fill placer, shoremen and a superintendent. The morning crew will build berms, contain the slurry, and build a gigantic hole for the night pumping if needed. The shore night crew is for safety.

Estimated initial dredging duration amounts to 7 months, excluding mob/demob. Project duration per nourishment event is approximately 2 months for the Encinitas beach replenishment and an additional 2 months for the Solana beach replenishment, excluding mob/demob.

10 Mitigation Costs

Habitat mitigation costs consist of kelp mitigation, and kelp transplanting.

10.1 Kelp Reef Mitigation

The overall purpose is to create a reef kelp habitat to offset lost habitat. Costs are associated only with Solana Beach reef mitigation. Encinitas beach nourishment does not result into kelp habitat loss.

The profile of the reef consists of a single rock layer rising no more than 1.5 feet off the existing sand seafloor. Quarry boulders are the exclusive construction material used to build reefs, specifically quarter-ton rock. Assume quarry boulders are transported to the placement site utilizing tugboats towing either 1 or 2 flat deck barges. Boulders are mined from quarries at Santa Catalina Island. As a reference, the project by Southern California Edison on the Wheeler North Reef at San Clemente (2008) had a variation of boulder deposition ranging from 743 to 987 tons per acre with an average of 865 tons/acre. Based on the Wheeler North Reef at San Clemente assume an overall average tonnage per acre of 685 with a coverage of 42% to 66% (average of 54% coverage).

Initially a derrick barge is positioned by tugboat above the designated dumping area. Motorized winch anchor lines moor the derrick barge within the boundary. During boulder deposition, the derrick barge is guided into the designated position by winching in or out on anchor cables connected to their respective anchors. Each anchor is connected by a cable to a concrete anchor block and then cabled to the derrick-barge. The locations of the anchors are routinely monitored by an attending tugboat and by the derrick barge winch operator. After securely tethering the supply-barge to the derrick-barge, the derrick-barge winch operator maneuvers the edge of the flat deck barge to the required position. The derrick-barge winch operator assists in locating the edge of the supply barge at the exact line of deployment. The stone is pushed in a windrows by a track dozer over the edge of the supply barge. Assume stone is allowed to be placed during day light hours, only. No placement is done at night, except for hauling.

Assume contract allows lead time for the quarry to fabricate the stone ahead of time.
Work schedule is 12 hr/day, 7 day/week.

10.2 Kelp Transplant Mitigation

The purpose is to transplant reef kelp habitat to offset lost habitat. Costs are associated only with Solana Beach reef mitigation since Encinitas beach nourishment does not result into kelp habitat loss. Mitigation involves transplanting adult plants and sporophylls. Assume kelp is harvested from around the project site. Kelp transplant will take place in deep waters. A pre-survey of the planting area will determine the planting grid. Harvesting and transplanting occurs within a 24-hr period. Divers harvest the kelps and hand them over to the boat crew for planting preparation. The kelp is attached to a CMU block and lowered to the mitigation site sea floor by a small crane.

Work schedule is 5 days/wk, 10 hr/day.
Assume work is subcontracted by the prime marine contractor.

10.3 Environmental Monitoring

Environmental monitoring takes places before, during and after dredging for each event. It starts with an Environmental Impact Assessment (EIA) to establish the environmental status of the project and predict how it would change after the project. During the project the environmental monitoring is conducted to confirm that management plan is having the desired effect. Continuation of the monitoring after the project's completion guarantees no long-term negative impacts. Work will be contracted out. Cost obtained from Planning Division, including markups.

10.4 Physical Monitoring

Physical monitoring involves measuring changes is elevation and volume through successive bathymetric surveys; taking sand samples; and measuring beach profiles. Physical monitoring is needed to quantify the benefits of the sand replenishment project. Work will be contracted out. Costs obtained from Coastal Design and include markups.

Additional lagoon sedimentation maintenance costs for San Dieguito, San Elijo and Batiquitos were provided by lagoon managers. Costs are based on on-going lagoon maintenance costs for their dredging cost maintenance.

11 Dredging Contractor Markups

The CWE is based on performing the work using the “Invitation for Bid” contract mechanism.

12 Planning, Engineering and Design (PED) and Construction Management

Planning, Engineering and Design (PED) and Construction Management estimates were based on labor-hour estimates provided by section chiefs. Associated burdened hourly rates were extracted from CEFMS.

13 Contingency

Contingency was derived from the Cost and Schedule Risk Analysis (CSRA). Please refer to the risk analysis study.

14 Escalation

Construction Escalation is based on the Civil Works Construction Cost Index System (CWCCIS) EM 1110-2-1304, dated 30 September 2012.

PED and Construction Management Escalation is based on EC 11-2-202 Table 1, Class 1 (Government Personnel)

Real Estate escalation is based on the Construction Price Yearly Index (CPI)

Estimate was inflated to mid-point of construction for the initial and subsequent nourishment events starting on 2015.

Please refer to the Total Project Cost Summary (TPCS) for breakdown.